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ABSTRACT

This paper and the accompanying CD-ROM disks are the outcome of a federally funded project to research and develop an interactive multimedia sign language training system for educational interpreters for students with deafness. The program consists of four 20- to 30-minute lessons on the use of non-manual grammatical markers in American Sign Language. Specific lessons are on question forms, topicalization, conditionals, and negation/assertion. The paper describes the procedures that were followed for designing, developing, and testing the interactive learning system. Features of the program include: (1) lessons provided on IBM-compatible CD-ROM disks; (2) textual instruction supplemented with video segments of fluent signers; (3) on-screen evaluation of the interpreter's understanding of how non-manual markers are being used in the video segments; (4) immediate feedback to aid the learning process; (5) video intensive lessons that present multiple models of deaf signers; (6) an interactive tutorial that explains major features and how to navigate the program; and (7) student interaction with each video by pausing, stopping or replaying the video, and by playing the video at normal or slow-motion speeds. (CR)

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ED 409 688

FINAL REPORT

MULTIMEDIA INTERACTIVE LEARNING SYSTEM FOR INTERPRETERS

Applications of Assistive Technology for Students Who are Deaf or Hard of Hearing
CFDA 84.180J2

AWARD NO. H180J30026

Prepared For:
U.S. DEPARTMENT OF EDUCATION
Office of Special Education & Rehabilitative Services
Office of Special Education Programs
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I. BACKGROUND

In July 1993, the U.S. Department of Education awarded a two-year grant to Subtle Impact Software, Inc. to research and develop an interactive multimedia sign language training system for educational interpreters for the deaf. The system was to incorporate sound, animation, graphics and video in an interactive computer environment to (1) strategically provide user participation and control; (2) fully exploit the powers of multimedia in providing sign language training; (3) isolate and intensify facial expressions, frozen forms, and body and gaze shifting; and (4) facilitate an evaluation-feedback capability. The final product was to consist of several lessons, with each lesson being approximately 30 minutes in duration.

II. PROJECT OVERVIEW

The project was divided into two phases. During Phase I (August 2, 1993 - August 1, 1994), a prototype lesson was designed, developed and tested. During Phase II (August 2, 1994 - August 1, 1995), modifications were made to the prototype's concept and design based on the Phase I testing. A final lesson was then developed and tested and used as a template to develop additional lessons.

The final product of this grant is a series of four lessons (titled *Subtle Messages*) on the use of non-manual grammatical markers in American Sign Language. Specific lessons are on Question Forms, Topicalization, Conditionals and Negation/Assertion. Although the lessons are primarily intended to support training of educational interpreters for the deaf, the lessons are beneficial to anyone who wants to learn or improve their American Sign Language skills.

III. PROJECT ACCOMPLISHMENTS

The overall technical objective was to design and develop a computerized, interactive multimedia learning system to enhance the training of interpreters for the deaf. The following paragraphs describe the procedures that were followed for designing, developing and testing the interactive learning system and the specific accomplishments for each of the objectives and tasks outlined in the original and continuation grant applications.

A. Phase I

1. Design a Multimedia Interactive Learning System

(a) Task 1. Determine the learning objectives and the interactive learning experiences necessary in developing adverbial markers and clausal boundaries in sign language.

A specific lesson was selected for prototype development. Subtle Impact wanted the lesson to be one that would be well suited for multimedia presentation and convincingly demonstrate the concept and feasibility. Therefore, the decision was made to develop the prototype lesson on "intonation in sign language" as expressed by the use of eyebrows, head tilt and body shift. The specific lesson objectives were:

The interpreter will:

(1) Understand the concept of intonation as used in voice and sign language.

(2) Understand and be able to recognize how eyebrows help communicate intonation in questions.

(3) Understand and be able to recognize how head tilt helps communicate intonation for marking sentence boundaries and emphasizing words.

(4) Understand and be able to recognize the use of body shift to mark clausal and sentence boundaries.

(b) Task 2. Define interactive multimedia requirement specifications needed in satisfying the learning objectives, interactive learning experiences, and the necessary hardware constraints in making this an affordable, effective system.

The initial requirement specifications were defined in terms of the interpreter training requirements, availability of computer equipment for playback, and the affordability of additional equipment needed to configure existing computer equipment. For the IBM and compatible configurations, the initial minimum requirements called for a multimedia-capable 386 computer with Windows 3.1 or higher, 100-200 megabytes available hard disk space, four megabytes of random access memory (RAM), and an SVGA monitor. However, as the program evolved, it became obvious that a more robust computer system would be required to effectively deliver interactive multimedia sign language training. The final minimum computer system capability required is a 486/66 Mhz with 8 MB of RAM, Windows 3.11 or higher and a SVGA monitor. The current series of four lessons require about 60 megabytes of hard disk space. With the rapid advances in technology and concomitant reduction in cost, this minimum system should be attainable by most agencies and individuals.

(c) Task 3. Based on the requirement specifications, develop multimedia interactive design specifications.

Based on the requirements for the program, a decision was made to use an authoring system that is specifically designed for interactive multimedia lesson development. After conducting an evaluation of existing authoring systems, we selected Authorware Professional as the most cost-effective system. The use of Authorware minimized the need for original programming but provided the capability to include the desired objects such as buttons, video, animation, sound, graphic displays. Since Authorware provided these capabilities, the specification of the design of the program became more closely aligned to the storyboard development process discussed under Task 5.

(d) Task 4. Design computer-based training (CBT) modules, an interactive hypermedia (IH) interface and assessment feedback tools in accordance with the design specifications.

The prototype was designed to provide the following features:

(1) The trainee had complete control of the pace of the lesson. The trainee was able to stop, pause, slow, reverse and restart each video segment.

(2) Navigation through the lesson was facilitated by decreasing the number of options the trainee could select at each screen and by using strong visual cues and instructional text.

(3) An evaluation/feedback component was included in the system for tracking an individual trainee's progress.

(e) Task 5. Storyboard and data flow chart the CBT modules, IH interface, and the necessary assessment tools needed in making the Subtle Impact multimedia interactive learning system an affordable, effective interactive multimedia system.

Storyboards and flow charts were developed and approved by the Project Director. The flow charts were integral to the Authorware development process and provided a visual flow of activities for each segment and the entire program. Also, an evaluation/feedback component was included in the system for tracking an individual trainee's progress.

2. Develop and Test Prototype

Based on the initial storyboards, a pre-prototype multimedia lesson on intonation in ASL using the eyebrows, head tilt and body shift was developed. This lesson included most of the intended features of the prototype and enabled Subtle Impact to develop and evaluate the initial approach and a variety of multimedia techniques (such as masking and full screen/partial screen, full-motion video). This lesson was then evaluated by a consultant. Based on the consultant's evaluation and recommendations, the storyboards were revised, and technical changes were made to complete the prototype development.

The prototype was then shown to faculty members of the Regional Interpreter Training Program, Front Range Community College. In general, they did not agree with the approach that was used to show how eyebrows, head tilt and body movement are used to provide intonation (each feature was presented separately). Since these features are used together for intonation, they suggested we shift our focus away from "intonation" to a more traditional approach which focuses on how these non-manual markers are used to indicate sentence types (wh-, yes/no, etc.). The program was then revised based on this recommendation and then demonstrated to Front Range

faculty members again. They agreed that the program has excellent potential for interpreters who have not attended formal interpreter training programs and could be used to complement existing interpreter training programs.

The program was then evaluated by educational interpreters attending a workshop at the Colorado School for the Deaf and the Blind and sign-language trainees and staff members of the Pikes Peak Center on Deafness. Additionally, the program was demonstrated at the "Educational Application of Technology for Persons with Sensory Disabilities Symposium," which was sponsored by the U.S. Department of Education/OSEP and the National Technical Institute of the Deaf (NTID); Rochester, NY; July 20-22, 1994.

The evaluation results reinforced the belief that interactive multimedia learning systems have great potential for training educational interpreters and also indicated that multimedia systems have additional benefits for teaching sign language to anyone. The evaluation also resulted in several recommendations for improving the program.

B. Phase II

Following an analysis of the Phase I evaluation, Subtle Impact reviewed and revised the system concept as necessary. The system was redesigned based on the lessons learned and Phase II development was initiated. During Phase II, Subtle Impact developed a complete multimedia interactive learning system and performed extensive tests of the final product. The goal was to have four market-quality lessons at the end of Phase II.

1. Redesign the Multimedia Interactive Learning System

(a) Task 1 & 2. Redesign the prototype, and develop the full-scale version of the lesson.

Based on the results of the Phase I evaluation, Subtle Impact redesigned the prototype. The redesign required a repeat of the design steps that were accomplished in Phase I. Specifically, this task required review and as-required modification of the lesson objectives, requirement specifications, design specifications, CBT modules and the storyboards. The redesigned prototype then became the first production lesson (Question Forms) and served as the model (template) for additional lessons.

The full-scale version was developed using the Authorware Professional authoring system based on the revised storyboards. This version was of production quality and incorporated text, full-motion video, graphics, animation and sound. Although the product was developed primarily for hearing interpreters, it was intentionally developed to be usable without sound for the benefit of the deaf and hard-of-hearing. After in-house testing and acceptance, the program was produced in limited numbers on CD-ROM disks to support beta testing.

To enhance our performance in Phase II, a closer working relationship was established with the Pikes Peak Center on Deafness (PPCOD). Under this relationship, the PPCOD defined the lesson objectives, content and storyboards; provided the deaf ASL models; and participated in the videotaping and the testing for each lesson. With this significant help in program content development from the PPCOD, Subtle Impact was able to concentrate more on resolving the technical aspects of the program (structure) and integrating the content into this structure. This enabled Subtle Impact to simultaneously work on the completion of four lessons.

These four lessons were defined to be Question Forms, Conditionals, Topicalization, and Assertion/Negation.

(b) Task 3. Conduct Beta Test/Field Evaluation.

Copies of the program were distributed on CD-ROM disks to both hearing and deaf persons for beta testing and field evaluations. The primary purpose of the beta tests was to evaluate the program's operability, functionality, and content. Test guidelines and questionnaire/report forms were developed to support the tests.

The original grant application proposed the use of the Educational Interpreter Performance Assessment (EIPA) process with interpreter trainees to evaluate the effectiveness of the iterative multimedia learning system. However, by the end of the grant, significant "bugs" continued to be found in the program, and the program was never stable enough to use the EIPA process. Therefore, all tests and evaluations were accomplished by the Colorado School for the Deaf and the Blind; The Pikes Peak Center on Deafness; and Sign Language Consultants, Inc., McLean, VA.

(c) Task 4. Fix and Retest.

Problems discovered during the tests were corrected, and the program was retested to insure the problems were actually resolved. However, many of the fixes were made after the completion of the grant.

(d) Task 6. Convert the program to run on the Macintosh computer.

Because of the "bugs" encountered in the IBM PC version, Subtle Impact was not able to convert the program to run on the Macintosh

computer during the period of the grant. However, this conversion is planned for future work.

C. The Final Product - *Subtle Messages*

The final product of this grant is a series of four lessons on the use of non-manual grammatical markers in American Sign Language. The series is titled *Subtle Messages* because the non-manual markers used by fluent deaf signers are often quite subtle. Specific lessons are on Question Forms, Topicalization, Conditionals and Negation/Assertion. Although the lessons are primarily intended to support training of educational interpreters, the lessons are beneficial to anyone who wants to learn or improve their American Sign Language skills.

Specific features of *Subtle Messages* are as follows:

1. The user is provided lessons on Compact Disk-Read Only Memory (CD-ROM) disks.

2. Lesson objectives are satisfied through the use of textual instruction supplemented with video segments of fluent signers, on-screen evaluation of the interpreter's understanding of how non-manual markers are being used in the video segments, and the use of immediate feedback to aid the learning process.

3. All lessons are video intensive and present multiple models of deaf signers. *Subtle Messages* contains over 700 video clips; therefore, a student can complete each lesson five times without seeing the same video twice. Eight different models from the local community are used in the program to give the student exposure to differences in signing among deaf signers.

4. The lessons are intuitive and easy to use. However, an interactive tutorial is included in *Subtle Messages* to explain the major features of the program and how to navigate through it.

5. The student can interact with each video by pausing, stopping or replaying the video and playing the video at normal or slow-motion speeds. This interaction enables the student to focus on the specific non-manual markers.

6. Each lesson is normally 20-30 minutes long; however, the lessons are student controlled, allowing the student to learn at his/her own pace.

D. Dissemination Activities.

Following are the activities used to disseminate information concerning the grant and its resultant product. The activities include those used during and after the period of the grant, as of the date of this report.

1. Subtle Impact representatives presented/exhibited at the following meetings and conferences during the period of the grant:

(a) The Boys Town National Research Hospital 8th Annual Conference on Issues in Language and Deafness; Boys Town National Research Hospital; Omaha, NE (October 1993)

(b) The National Technical Institute of the Deaf (NTID) National Symposium on Educational Applications of Technology for Persons with Sensory Disabilities; Rochester, NY (July 1994)

(c) The Conference of Interpreter Trainers Tenth National Convention; Charlotte, NC (October 1994)

(d) The Boys Town National Research Hospital 9th Annual Conference on Issues in Language and Deafness; Nebraska City, NE (October 1994)

(e) Colorado's 1994 Symposium on Deafness: Colorado Springs, CO (November 1994)

(f) The California State University, Northridge (CSUN) Tenth Annual Conference: "Technology and Persons with Disabilities" (March 1995)

(g) The Project Director's Conference in Washington, D.C. (July 1995)

(h) The 14th Biennial National Convention of the Registry of Interpreters for the Deaf; New Orleans, LA (August 1995)

(i) The "Technology for Kansans Project"; Topeka, KS (September 1995)

(j) Colorado's 1995 Symposium on Deafness: Copper Mountain Resort, CO (October 1995)

2. Mailings were sent to over 2,000 agencies and individuals who may have an interest in *Subtle Messages*. Each mailing included a letter and brochure which explained the background, features and benefits of the program. A post card, to be used to order a *Subtle Messages* demonstration CD-ROM was also included. The recipients of the mailings included schools and local programs, university and college programs (interpreter and teacher training programs), professional service organizations and state and local government agencies.

IV. SUMMARY

A two-year grant was awarded to Subtle Impact Software, Inc. in July 1993 to research and develop a multimedia interactive learning system to enhance the training of educational interpreters for the deaf. This grant has resulted in the development of four interactive multimedia lessons on the use of non-manual grammatical markers in American Sign Language. These lessons are on Question Forms, Topicalization, Conditionals and Assertion/Negation; are on CD-ROM disks; and are available for purchase as a package. The current lessons are usable on IBM and compatible computers; however, a Macintosh version will be available in the future.